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AUTHOR Cannon, John R.; Crowther, David T.
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ABSTRACT

This paper takes a close look at a large county public school in northern Nevada and its implementation of a newly adopted standards-based elementary science program. The study investigates the opinions of elementary classroom teachers about the new hands-on activity-based science program for kindergarten through grade six. The results indicate that teachers feel that there is not enough time to complete all the required units in the allocated time, the unit materials do not cover class sizes, sharing the kits is awkward, and more time is needed for teachers to experience the lessons and share ideas about how to overcome problems. A discussion of the school district's decision to adopt a kit-based science curriculum as opposed to taking steps toward real science education reform is provided as well as details about the support provided by the district to teachers during the implementation process. The findings imply that school districts can increase the effectiveness of their reform efforts by investing more money in implementation of science curricula and less on the adoption phase. Contains 11 references. (DDR)

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AN AUTOPSY OF AN ELEMENTARY SCIENCE PROGRAM IMPLEMENTATION

John R. Cannon, Ph.D.

and

David T. Crowther, Ph.D.

College of Education

University of Nevada, Reno

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Introduction and Problem

The publication of the American Association for the Advancement of Science *Benchmarks for Science Literacy* (AAAS, 1993) and the *National Science Education Standards* (National Research Council, 1996) has brought a renewed and focused interest back to elementary science education reform in the United States. In concert with reform, elementary science curriculum development, adoption, and implementations also take place. The research base concerning effective hands-on, activity-based elementary science curricula is well documented in many publications(for a concise summary, see DeBoer, 1991). Curriculum adoption models are also prevalent in the literature(Kyle, 1986; Jones & Steinbrink, 1986; Van Den Akker, 1988; Bybee & Landes, 1990; Kwan, 1994; Jones, 1995). Elementary science program implementations, or models, however, are not nearly as extensive. Research has revealed effective curricula and instruction, but lacks in how best to implement such ideals especially in a large county public school district (AAAS, 1993; Bybee, 1993; Gabel, 1994; Pressley, Harris, & Marks, 1992).

This research takes a close look at a large county public school district in northern Nevada and its implementation of a newly adopted, standards-based elementary science program. The process was typical and regularly scheduled for the school district reviews content areas curricula and programs every seven years.

Objectives of the Study

The objectives of this study were to investigate the opinions of elementary classroom teachers about the implementation of a recently adopted new elementary science curriculum. A *program* was defined as the medium chosen to deliver the adopted curriculum. Program is not synonymous with curriculum in this research. *Implementation* was defined as the school district's process of assisting teachers in teaching the new science program.

The program implemented was Scholastic's *Science Place* -- a hands-on, activity-based elementary science program for K-6. *Science Place* consists of units, or kits, made up of literature, student readers, activity worksheets, and some non-consumable science teaching materials. Kits are shared within grade levels. Each grade typically has 5-6 units to complete during the year. It was

hypothesized that the school district was not meeting the needs of the classroom teachers, due to numerous anecdotes offered by teachers to the researchers.

Significance

The literature is replete with accounts of "new" elementary science curricula and program development of the late 1960's continuing to the present. Many of these new elementary science curricula have become somewhat established and have gone through a series of versions. One example is the *Science Curriculum Improvement Study* (SCIS). The program has undergone three revisions to date and is currently titled as *SCIS III*.

It appears from the literature that once a new program is developed, little has been done to investigate the *implementation* of the program within the elementary classroom. While some studies have investigated implementation procedures (Kyle et al., 1989; McMahon, 1990), little research has been offered into the knowledge base as of late. This problem is even more pronounced in the lack of studies investigating program implementation in large public school districts. With the publishing of the AAAS *Benchmarks* and *National Science Education Standards*, hopefully more public school districts will be considering changing their science curriculum and instruction.

Theoretical Underpinnings

Teaching elementary science is more than merely following a "teacher proof" curriculum in which the teacher merely mimics what the teaching manuals tell them to say, resulting in their students "learning" science. Past efforts, such as the lack luster acceptance and wide spread use of the Elementary Science Study(ESS), authored in 1969, is a prime example. Many of the activities used in subsequent elementary science programs, or source books, can be traced back to an original ESS activity, or lesson. Typically, these activities or lessons are hugely successful when used in the classroom, if they are first properly presented, modeled, and practiced with pre and inservice teachers. It is difficult to speculate what impact programs like ESS would have had on students if more resources would have been put into the implementation process, than the adoption process, in school districts across the nation.

The recent *National Science Education Standards* (1996) includes a chapter entitled *Science Education System Standards*. It outlines how school districts might implement the many changes called for in science education reform. While the chapter, nor document as a whole, promotes a specific elementary science program per se, the *Standards* do offer at the very least a model for standards-based reform that would most likely include some kind of new program implementation. The model is clear and concise, but fails to address any potential pitfalls with program implementation in the classrooms.

Context of the Elementary Science Program Adoption

Before examining the design and procedure section of this paper, the reader needs to know the historical context of the school district 's curriculum review and program adoption process preceeding this research. Beginning four years ago, the school district completed an elementary science curriculum review and revision before reviewing any elementary science programs. At first, the curriculum committee suggested searching out a thematic-based science program for consideration but none were found that closely matched the district's curriculum. Consequently, a nation wide invitation was sent to any sizable educational publisher requesting a sample of their materials be sent to the school district for review and piloting. Numerous publishers sent materials. All major publishers were considered, i.e., Addison-Wesley, Silver-Burdett, etc. No representatives from the publishing companies were allowed to contact any of the members of the school districts elementary science program review committee.

The program review committee, which was separate from the curriculum review committee, was charged with reviewing each set of materials submitted and piloting the materials wherever possible. All programs were piloted. No district inservice on current best practice in science teaching or learning was given to the program review committee previous to the reviews. The district felt that any inservicing would "taint" the individual reviewers. Program reviews consisted of a rating scale evaluating parts of the program such as learning theory, hands-on program, materials or manipulatives, etc. Subcommittees of the whole review committee would review each program and then discuss their findings to reach a consensus of opinion about the program.

Upon completion of all reviews, the committee as a whole was reconvened to hear testimony from teachers piloting each program. These teachers were seldom concurrently serving on the program review committee. Often, very heated and tense exchanges took place between the piloting teachers

and the reviewers. Too, discussions regarding what exactly constituted "best teaching practice" emerged from these meetings and discussions. While, in general, one might report that the review committee thought that a hands-on, activities-based elementary science program would be the best for the students in the district, consensus was never fully reached with the program review committee. The previous elementary science program used in the district was *Holt Science*, a textbook program with no hands-on materials supported.

To close the process, a vote was taken on each reviewed program, and the top three voted programs were then asked to send company representatives to the school district to explain and promote their product. All companies did sent representatives for promotional meetings. When all were completed, the review committee, as a whole, voted for the program to adopt. In this case, the school district proceeded to adopt Scholastic's *Science Place*.

The final cost of the program for the 56 elementary schools in the district was just under 1 million dollars. Inservice training, provided by Scholastic, was also negotiated into the adoption agreement. School district *Science Place* trainers were inserviced by Scholastic and then paid by Scholastic to go out to each of the 56 elementary schools and provide after school inservice workshops for the classroom teachers about *Science Place*. The final *Science Place* teacher training team totaled ten local elementary school teachers. The program is currently in its third year of use. It is scheduled for review again beginning in three years.

Design and Procedures

This survey research was conducted in a large county public school district in northern Nevada comprised of 56 elementary schools(K-6) employing 1,397 elementary classroom teachers, for an elementary student population of 28,850 children. A purposeful, stratified sampling procedure(n = 120) was employed to gather data concerning the new elementary science program implementation. Teachers in all grades(K-6) from all school socio-economic levels(lower to upper class) were represented in the sample. The surveys were developed and distributed to district elementary teachers in conjunction with an elementary education Masters degree curriculum class. 60 of the surveyed teachers responded for a response rate of 50%. The data collected in the surveys were analyzed, compiled, and reported to the curriculum class and to the researchers.

The survey statements included:

1. Grade level(s) you teach
2. Years of teaching experience
3. Are you familiar with the 1994 school year science curriculum adoption? Yes No
4. Do you feel comfortable using the new science program? Yes No
5. Have you attended ANY science workshops on the new Scholastic *Science Place*? Yes No

   If yes, how many?
6. How many hours of science do you teach a week?

   Of those, how many are taught from *Science Place?*
7. How many *Science Place* units do you complete or plan to complete in one year?
8. How many times a week does your class conduct hands-on experiments (labs?) ?

   If not, why?
9. Do you feel that *Science Place* is relevant to the curriculum?
10. Is assessment adequately covered by *Science Place?*

    If not, why? How do you assess?
11. Do the Teacher's Manuals provide enough information to help you teach the lessons? Yes No
12. Any additional comments regarding *Science Place*

Findings

The responses were quantified when possible, and teachers hand written "additional comments" were recorded from the surveys. The grade levels represented in the survey consisted of 6 first grades, 12 second grades, 5 third grades, 8 fourth grades, 5 fifth grades, and 9 sixth grades. The school district has many multi-age and team-teaching classrooms and thus, the total number of responses and classrooms surveyed do not match.

The average number of years teaching was 10 years. 98% of the respondents reported being "familiar" with the new *Science Place* program and 88% felt "comfortable" teaching it. It is interesting to

note, however, that only 59% of the teachers reported attending a district workshop on how to use *Science Place* in the classroom. The range of attended workshops were 0 to 4. Teachers averaged 2.5 hours of elementary science instruction per week and 1.7 hours of this instruction was from *Science Place*. Completed *Science Place* units during the year numbered 3.9. Hands-on science activities, or lessons, were reported to take place 2.1 times per week. 85% of the teachers believed *Science Place* to be relevant to the district science curriculum. Adequate assessment was reported by only 51% of the teachers and the *Science Place* Teacher Manuals were rated by 68% of the teachers as providing enough information to help teach the science lessons.

Concerning "additional comments" teachers continually reported that 1) there was not enough time during the year to complete all of the required *Science Place* units; 2) unit materials did not cover class sizes; 3) sharing of the kits were awkward; and 4) still more time was needed to be devoted to the teachers experiencing *Science Place* lessons and sharing ideas on how to overcome these problems. In general, the teachers reported that the school district did not offer an appropriate method for implementing the new science program.

Discussion and Comments

As with any good research, more questions were raised from this endeavor than were really answered. What we feel is the most ironic result of this research is that the school district did, in fact, follow a model of both curriculum and program adoption that was *freakishly* close to the one presented in the *National Science Education Standards* (Chapter 8, National Research Council, 1996). All members of the educational community were involved in the process and all had some influence on the outcome. This is a very reassuring aspect of this research. We also believe the final vote of the program review committee truly represented the teachers' desire, with the non-financial blessing of the school district, to take a step in the direction of *real* science education reform. This step, however, was doomed from the beginning to trip and fall.

Three major effects have drastically slowed the momentum of science education reform in the school district. They are 1) lack of continued inservice training for the teachers using *Science Place*, 2)

lack of district funds to support and *implement* the program selected; and 3) school district mandates, or incentives, for the teachers to attend the *Science Place* inservice workshops.

Inservice training has always and will always be a problem plaguing curricular implementations. The California Framework for Science Education (Reed & Calhoon, 1992) states that "they key problem blocking rapid implementation of the *Science Framework* is a tight state budget" (p. 8). What state, or local school district, doesn't have a "tight budget"? Accepting this lack of funding, the school district's zeal to move ahead in science education was doomed to fail due to lack of inservice funds to make sure that *every teacher* had some first hand experience with the new science program. To be clear, the school district adoption funds could *only* be used to purchase education materials; not for teacher training. No funds were made available for inservice. No inservices occurred before the beginning of the new school year. Whatever inservice workshops did finally take place occurred approximately 3 months into the school year and were largely left up to the decision of the local school staff due to the site-based management system of the school district.

To the credit of the school district's *Science Place* trainers, some teachers did have effective experiences using the new program, yet others, who never attended the after school workshops, continue to report troubles with the program. Some proactive schools arranged for their staff to receive credit toward recertification or movement on the salary schedule, however, the vast majority did not and, in one training session, only 3 teachers from a staff of 15 attended. Without some incentive, the goal of teachers gaining successful experiences in *Science Place* will continue to fall short. While the school district came very close to implementing real change, only time will tell in the near future, if the innovations will remain in place or be replaced with a less ambitious elementary science program.

Science reform efforts of all kinds will have a rough road to follow for years to come. While there will be pockets of great successes, the science education and research communities need to focus on elementary science program implementation in order to spread the word of these successes. If not, more autopsies will be performed on more school innovations in the future.

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